

Deep Space 1 Mission Overview

JPL Clearance #CL00-0257

Final

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Marc D. Rayman
Jet Propulsion Laboratory
California Institute of Technology

Agenda

- Deep Space 1 project objectives
- Technology payload
- Spacecraft configuration
- Mission overview
- Technology benefit example
- Questions/discussion
- Attend remainder of symposium presentations
 - Break for lunch
- Attend reception and dinner
- Stop at store on way home
 - Milk
 - Bread
 - Toothbrush
 - Xenon
 - Bananas

DS1 Mission Success Criteria

- 1) Demonstrate the in-space flight operations and quantify the performance of the following advanced technologies:
 - Solar electric propulsion
 - Solar concentrator arrays
 - Small deep space transponder
 - Miniature camera and imaging spectrometer
 - Autonomous navigation
- and 3 of the 6 following advanced technologies:
 - Autonomous remote agent
 - Beacon monitor operations
 - K_a-band solid state power amplifier
 - Low power electronics
 - Multifunctional structure
 - Power actuation and switching module
- 2) Acquire the data necessary to quantify the performance of these advanced technologies by September 30, 1999. Analyze these data and disseminate the results to interested organizations/parties by March 1, 2000.
- 3) Utilize the on-board Solar Electric Propulsion (SEP) to propel the DS1 spacecraft on a trajectory that will encounter a near-Earth asteroid in FY 1999.
- 4) Assess the interaction of the SEP system operations with the spacecraft and its potential impact on charged particle, radio waves and plasma, and other science investigations on future SEP propelled deep space missions.

DS1 Technology Payload

- Solar electric propulsion
 - Provided by NSTAR (NASA SEP Technology Applications and Readiness) Program
 - $2.5 \text{ kW} \leftrightarrow I_{\text{sp}} = 3100 \text{ s}$; throttle in discrete steps to $0.5 \text{ kW} \leftrightarrow I_{\text{sp}} = 1900 \text{ s}$
 - Diagnostics sensors for E and B, energy and density of electrons and ions, and surface contamination
- Solar concentrator array
 - Provided by BMDO
 - Arrays of cylindrical Fresnel lenses over strips of GaInP₂/GaAs/Ge
 - 2.5 kW at 1 AU BOL
- Miniature integrated ion and electron spectrometer
 - Energy and angle analysis for electrons and ions
 - Ion mass analysis
 - Microcalorimeter
- Miniature integrated camera and imaging spectrometer
 - 2 visible imaging channels
 - IR and UV imaging spectrometers
 - Shared 10-cm primary mirror

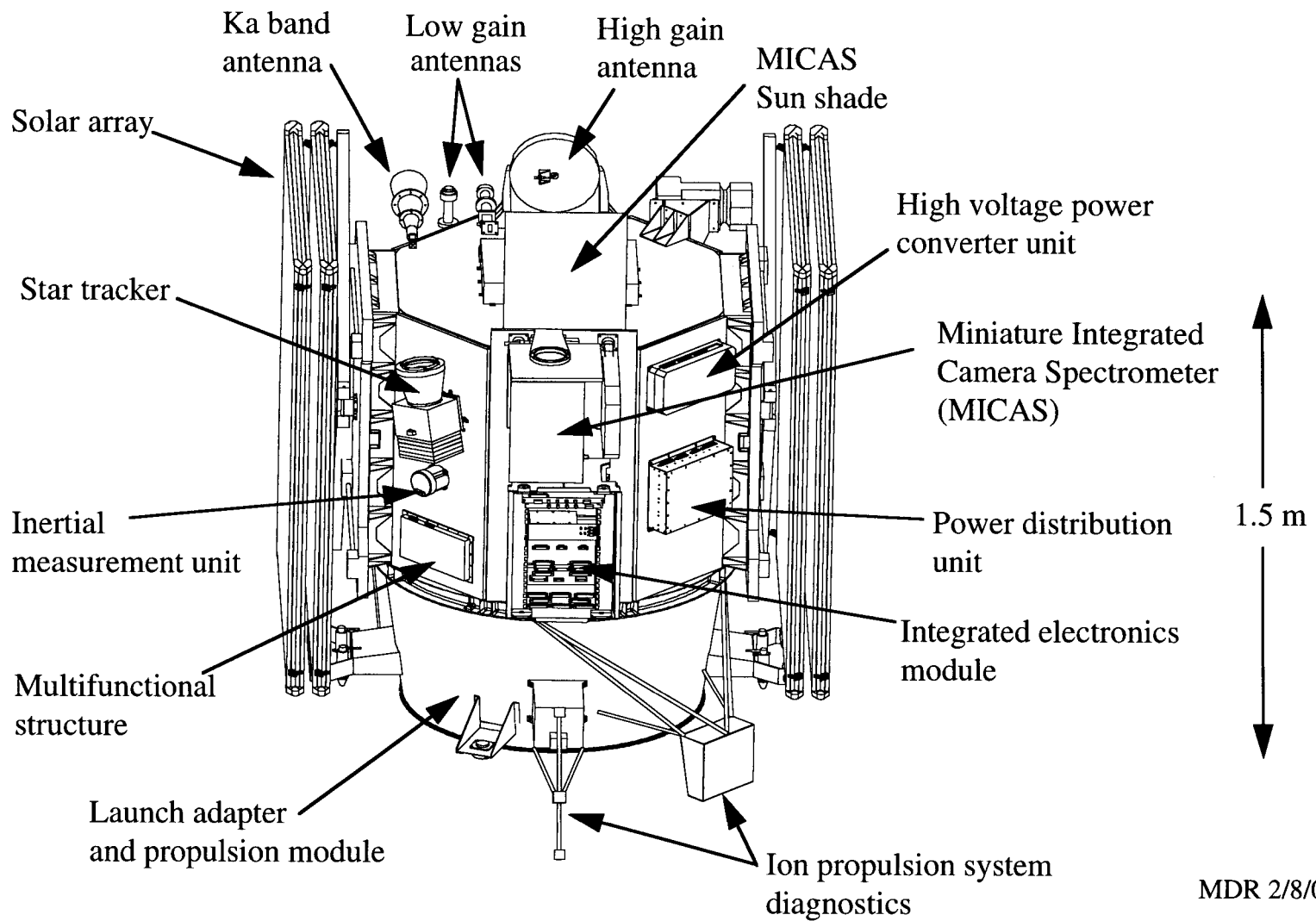
DS1 Technology Payload (Cont'd)

- Autonomous optical navigation
 - Acquisition and processing of images of asteroids against stellar background
 - Orbit determination
 - Maneuver design and execution
 - Direct commanding of IPS, MICAS, and ACS
- Remote agent
 - Planner/scheduler to generate a set of activities
 - Executive to expand that to a sequence of commands and to monitor their execution
 - Mode identification and reconfiguration
- Beacon monitor operations
 - Summarization of spacecraft health data and transmission of 1 of 4 tones to indicate urgency of request for ground action
- Small deep-space transponder
 - X-band receiver, X-band and K_a -band exciters, CDU, TMU, and beacon tone generator
- K_a -band solid state power amplifier
 - Enabled K_a -band downlink telecommunications tests and DSN system tests

DS1 Technology Payload (Cont'd)

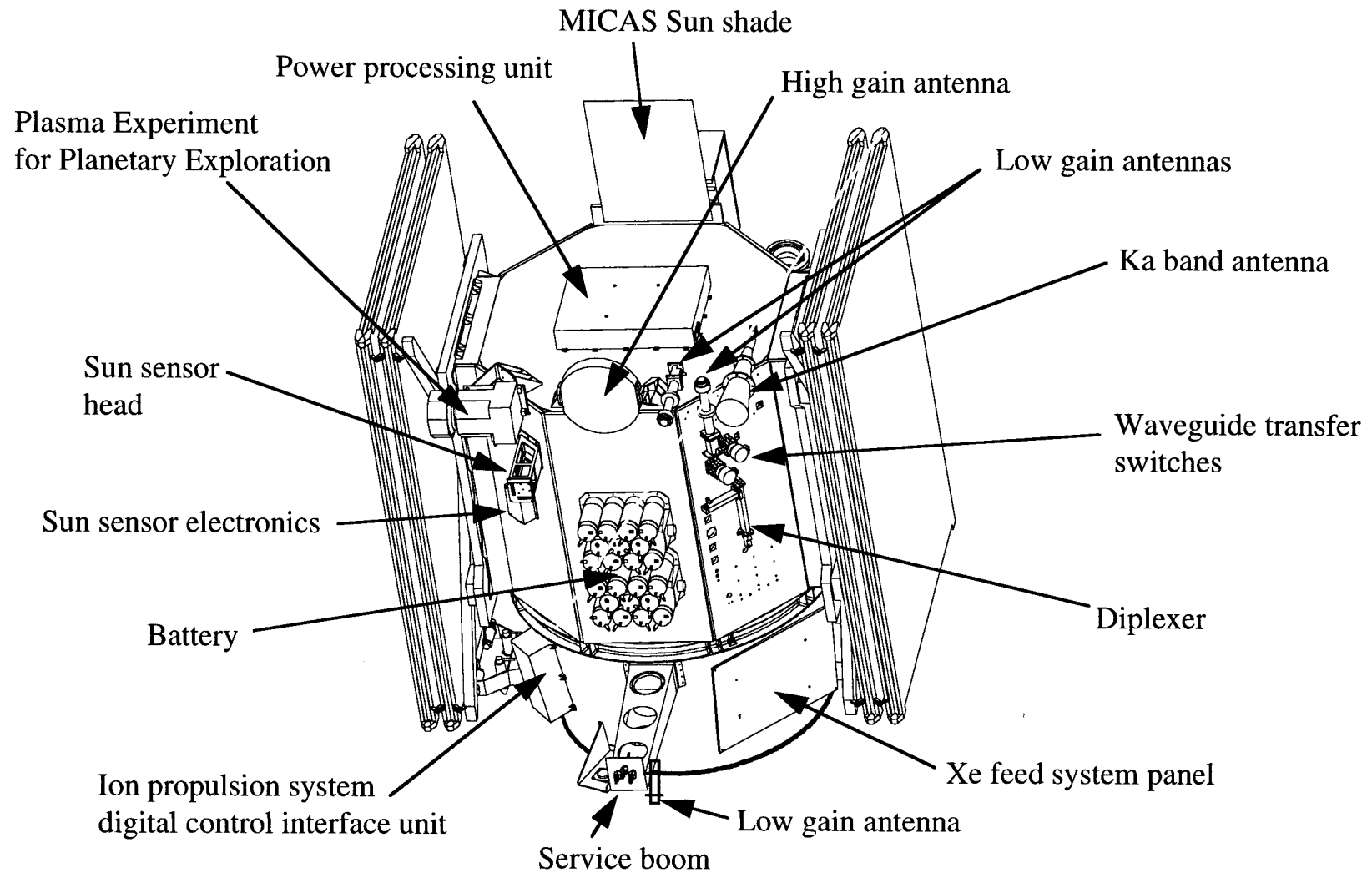
- Power actuation and switching module
 - Power switch using high-density interconnects with mixed signal ASIC controller
- Low power electronics
 - 0.9 V logic, 0.25 μm feature size
- Multifunctional structure
 - Electronics integrated into load-bearing structural element

Stowed Configuration



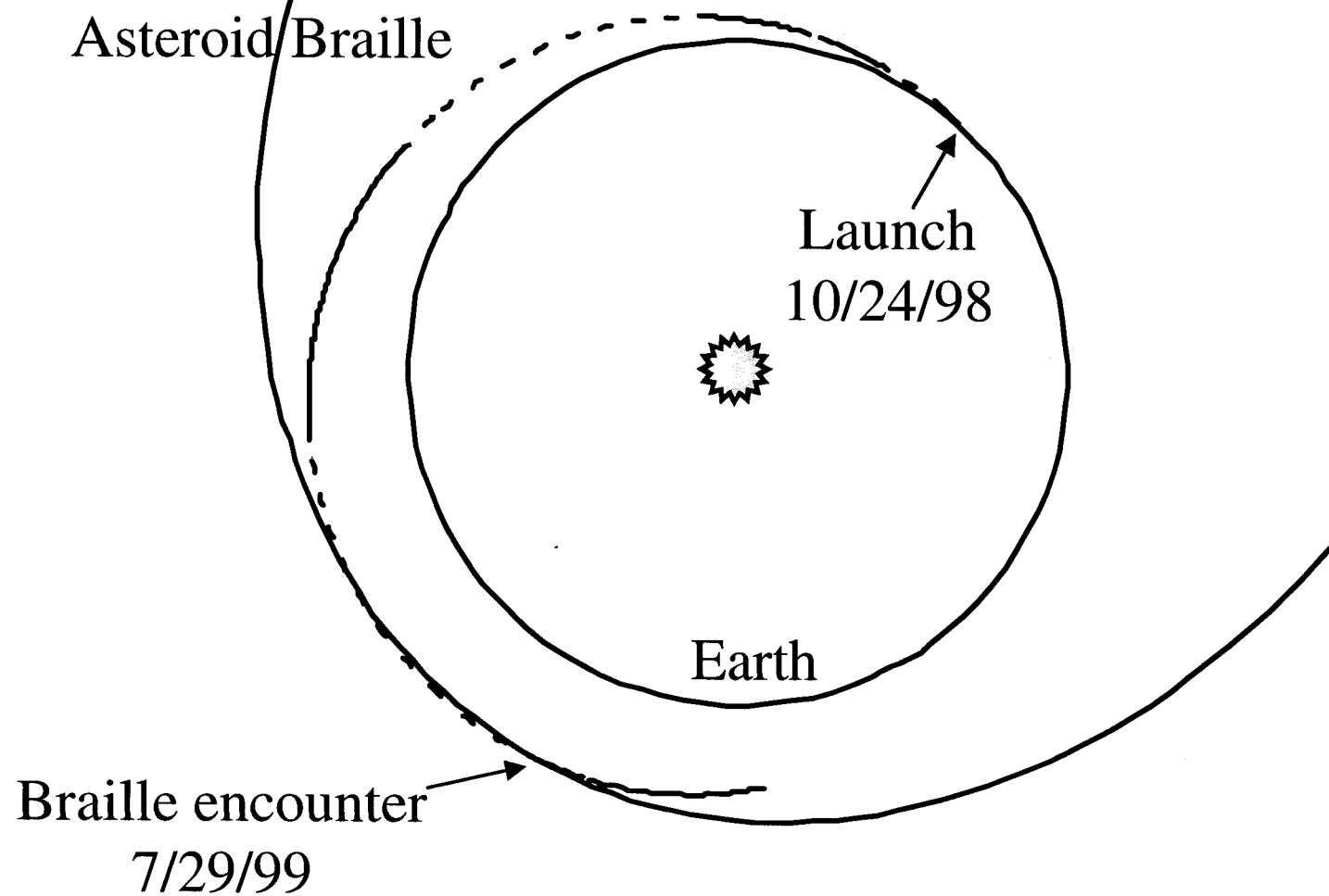
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Stowed Configuration

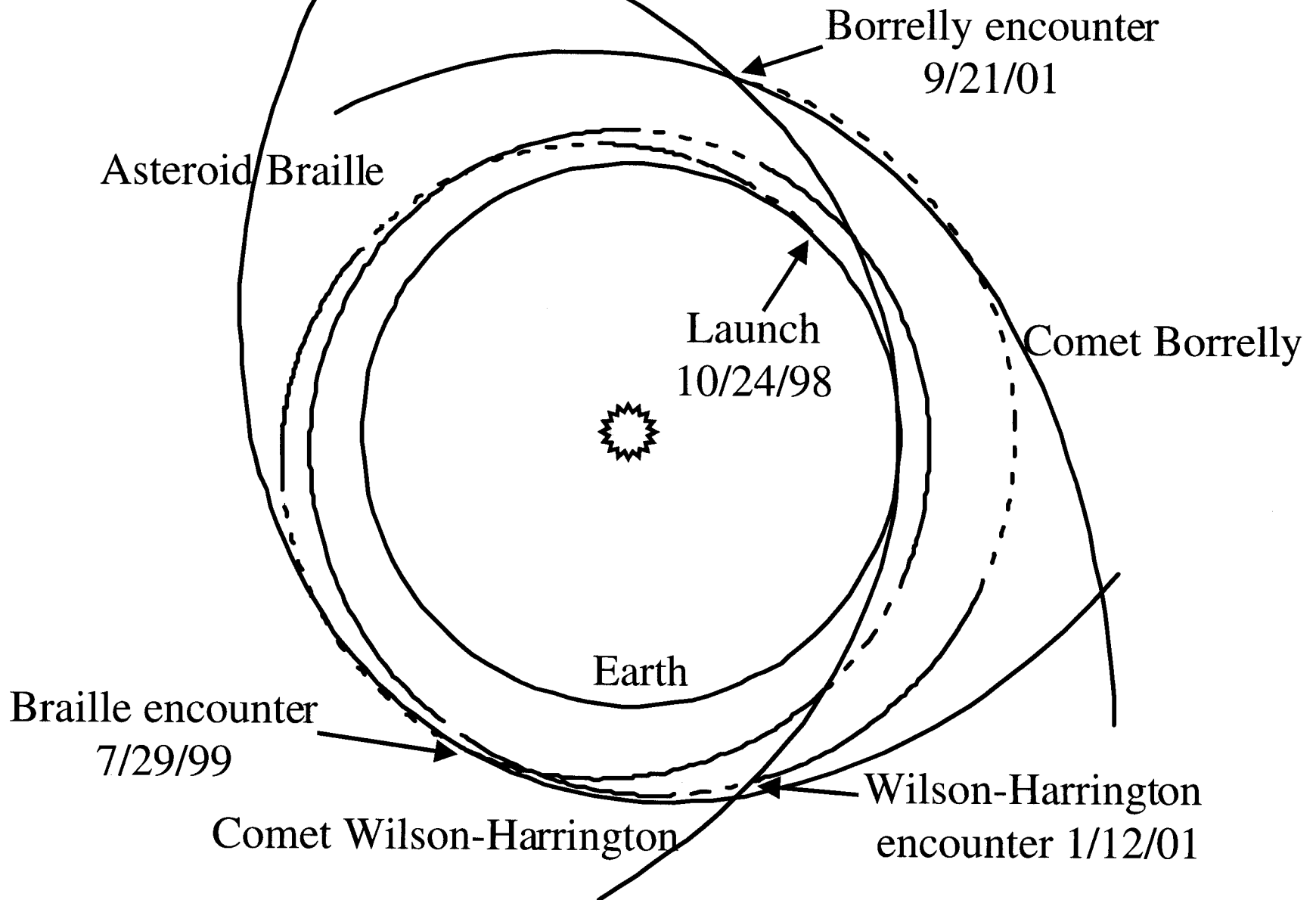


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Deep Space 1 Trajectory



Deep Space 1 Trajectory



Technology Benefit Example

- Mission concept:
 - Same encounter targets as DS1 for primary and extended missions
 - Standard technologies with similar functionality:
 - N_2O_4 /MMH propulsion system
 - Scaled solar array
 - Mars '98-class telecommunications system
 - Cassini-class plasma spectrometer
 - Separate visible imager and IR push-broom spectrometer

	"Standard technology" DS1	Actual DS1
Injected mass	~ 1300 kg	486 kg
Launch vehicle	Shared Atlas IIA	Shared Delta 7326